MASTER OF SCIENCE
IN
SYSTEMS TECHNOLOGY

THE USE OF POINT-TO-POINT LASERS FOR NAVAL SHIPS

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Currently, the Navy uses microwave technology to wirelessly connect ships at sea. These systems provide approximately a 1.5Mb/s transfer rate and have some significant drawbacks. Microwave antennas provide a very large electromagnetic signature, require a large power source, and require a lot of support equipment and personnel to maintain connections.

Laser technology can offer connection speeds 50 times greater than microwave, has no electromagnetic signature, uses only a fraction of the space and power requirements, and requires little to no personnel maintenance. Lasers offer many advantages to their microwave counterpart, but may also have some drawbacks. This thesis addresses the effects inclement weather will have on range and bandwidth. Weather, ranging from fog to heavy rain, is also analyzed in relation to the current system.

Aside from communications between ships, lasers offer other untouched tactical benefits, including enhanced communications between ships and remote controlled drones. Unmanned vehicles could provide full motion video, telemetry, atmospheric conditions, and provide an uplink for smaller water or land based terminals to the ship.

KEYWORDS: FSO, Laser Communications, Free Space Optics, Networking, Ship Networks

JOINT FIRES NETWORK ISR INTEROPERABILITY REQUIREMENTS WITHIN A JOINT FORCE ARCHITECTURE

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The Navy is aggressively pursuing a capability for Fleet units to combine intelligence information into one common picture to allow for rapid correlation of multiple pieces of intelligence. This capability would contribute significantly to reducing the "sensor-to-shooter" timeline and significantly increase the likelihood of correctly classifying and striking a contact of interest. This capability comes in the form of a program called Joint Fires Network (JFN). The concept was forged through several Fleet Battle Experiments (FBEs) as well as lessons learned from the Persian Gulf War. The objective of this thesis is to examine JFN within the Department of Defense's ISR architecture of the future. This theses will look at what is envisioned for the future of DoD's ISR systems and how well JFN will function as both a customer and provider of ISR information within a Joint Force architecture. This thesis uses the ISR Integrated Capstone Strategic Plan (ISR-ICSP), developed by the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (C3I), as the foundation for what DoD's ISR architecture of the future will look like. This thesis looks at the Operational and System Level Architectures spelled out in this document and examines the Navy's stated requirements and existing programs which comprise JFN. This thesis also looks at the ISR systems which each service is planning for the future, and how well JFN will share ISR information with these systems.

KEYWORDS: Joint Fires Network, JFN, Interoperability, Intelligence, Surveillance, and Reconnaissance, ISR, DCGS, DCGS-N, Distributed Common Ground/Surface System, Distributed Common Ground/Surface System-Navy, Naval Fires Network, NFN

THE IMPACT OF NEW TECHNOLOGIES ON SHIPBOARD COMMAND AND CONTROL

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An investigation of how fuel cells, an integrated power system, and directed energy weapons will affect the shipboard command and control process. The focus is on the implementation of the new technologies onboard near-term and far-term destroyer variants and the resulting changes to the command and control process.

KEYWORDS: Fuel Cells, Integrated Power System, Directed Energy Weapons, Command and Control

AN XML-BASED MISSION COMMAND LANGUAGE FOR AUTONOMOUS UNDERWATER VEHICLES

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Autonomous Underwater Vehicles (AUVs) are now being introduced into the fleet to improve Mine Warfare capabilities. Several AUVs are under government-contracted development. Mission planning and data reporting vary between vehicles and systems. This variance does not pose an immediate problem, as only one AUV is currently in production. However, as more AUVs are put into production, commands will begin to get multiple AUVs. Without a single mission command language, multiple systems will require familiarity with multiple languages.

Extensible Markup Language (XML) and related technologies may be used to facilitate interoperability between dissimilar AUVs and extract and integrate mission data into Navy C4I systems. XML makes archive maintenance easier, XML documents can be accessed via an http server, and, in root form, XML is transferable on the fly by stylesheet.

This thesis presents an XML-based mission command for the command and control of AUVs. In addition, this thesis discusses XML technology and how XML is a viable means of achieving interoperability. Furthermore, this thesis provides an example mission file using existing software, and demonstrates the future of XML in AUV technology. Finally, this work ends with a compelling argument for the use of an XML-based mission command language to command all AUVs.

KEYWORDS: Autonomous Underwater Vehicles, AUVs, Tactical Command Language, Telemetry Validation, Underwater Robots, Mine Warfare

EVOLUTION: ADVANCING COMMUNITIES OF PRACTICE IN NAVAL INTELLIGENCE

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The U.S. Navy is embracing the principles of Knowledge Management (KM). One of the key components of KM is the Community of Practice. Communities of Practice are groups that form to share what they know and to learn from one another regarding some aspect of their work. Organizations are strengthened through an improved network of contacts and enhanced productivity from their personnel. Personnel benefit through peer-group recognition and continuous learning. This thesis seeks to provide an understanding of how the Naval Intelligence Community, through the implementation of Communities of Practice, can reduce duplication of effort, increase collaboration between its personnel, and better support the resources of its people. In this thesis, a blueprint for building a successful unclassified Community of Practice for Naval Intelligence is provided. This blueprint is designed to support replication on classified networks.

KEYWORDS: Communities of Practice, Knowledge Management, Virtual Community, Collaboration, Social Networks, Information Sharing, Knowledge Networks

AN ANALYSIS OF THE ACQUISITION PROCESS OF THE JOINT FIRES NETWORK/TACTICAL EXPLOITATION SYSTEM-NAVY

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There is a growing movement throughout the Department of Defense (DoD) towards the implementation of Network Centric Warfare (NCW). In an effort to transition to NCW, the Navy has fielded many different technologies. One system exploiting new technologies in the Intelligence, Surveillance, and Reconnaissance (ISR) domain is the Joint Fires Network/Tactical Exploitation System-Navy (JFN/TES-N), which was developed from the Army Tactical Exploitation System (TES-A).

This system was developed rapidly and uniquely for fleet deployment in accordance with the interim acquisition guidance signed by the Honorable Paul Wolfowitz. This guidance authorized Evolutionary Acquisition following a Spiral Development process in lieu of the "traditional" cold war process described in the DoD 5000 series publications. Assuming that JFN/TES-N will be viewed as a successful acquisition, several Navy personnel have stated that it may become the model for future C4I (and other) system acquisitions. This thesis seeks to help develop that model. The objectives of this thesis are: to examine whether the TES-N acquisition process is an appropriate model of Evolutionary Acquisition following a Spiral Development, and to identify and make recommendations for changes or improvements to the TES-N acquisition program, so it can be used as a more appropriate model for Evolutionary Acquisition following a Spiral Development.

Finally, in the author's opinion on Evolutionary Acquisition following a Spiral Development shown with the JFN/TES-N system, this acquisition policy is appropriate for programs of the same size and scope, but larger more complex programs will not have as much success. Yet, in order for the JFN/TES-N program and future programs using Evolutionary Acquisition following a Spiral Development to succeed, changes have to be made in policies such as budgetary submissions, test and evaluation, policy, process, and training.

KEYWORDS: Evolutionary Acquisition, Spiral Development, JFN/TES-N

CONCEPT OF A DYNAMIC ORGANIZATIONAL SCHEMA FOR A NETWORK-CENTRIC ORGANIZATION

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In this thesis, the author examines the concept of a network-centric organization using the FORCEnet example that has been proposed by the CNO's Strategic Studies Group XIX. FORCEnet is presented as a knowledge-based construct that is a tool to organize forces in an envisioned environment of network-centric warfare. Mapping of organizational structure to these environmental conditions was found to require a multi-dimensional functionality that produced a capacity for directive, adaptive, and emergent behavior. This functionality was proposed as a requirement for a dynamic organizational schema that would serve as an organizational structure for joint operations using network-centric technologies. The schema was modeled using a cybernetic model that accounted for discreteness in organizational structure, inertia to dynamic conditions, and associated costs of change. The model demonstrated that it is possible to shift organizational structure to attain a desired functionality as set by the commander of the joint force, and that an organizational structure that operated in the center of the functionality was best fit to adjust to dynamic conditions.

KEYWORDS: Network-Centric Organization, Network Warfare, Complex Adaptive System, FORCEnet, SJFHQ, CNO Strategic Studies Group

LITERATURE SURVEY ON NETWORK CONCEPTS AND MEASURES TO SUPPORT RESEARCH IN NETWORK-CENTRIC OPERATIONS

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The United States Navy and its joint partners continually seek to maintain a responsive, agile, and effective fighting force well suited to combat present-day threats to national security. As a result, U.S. forces are currently undergoing force transformation to adopt an organizational structure capable of supporting this mission. This new organizational structure is known as Network-Centric Warfare.

The purpose of this research is to analyze any performance metrics, measures of effectiveness, or analytical methods used by existing organizations engaged in network-centric operations that would assist the Navy and joint forces with their transformation process. This research is done in the form of a literature review, examining existing material written on communication, economic/business, and social/organizational networks. In addition to identifying quantitative and qualitative metrics, an emphasis is placed on the methodologies used for network assessment. Final sections relate findings from each resource to Network-Centric Warfare and address matters relevant to the future of force transformation.

KEYWORDS: Netcentricity, Network-Centric Operations, Measures of Effectiveness

A FORCENET FRAMEWORK FOR ANALYSIS OF EXISTING NAVAL C4I ARCHITECTURES

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This thesis explores the definition of FORCEnet, determines what degree of consensus exists about its concepts, and evaluates the Joint Fires Network against FORCEnet principles. The military has been moving toward network based information operations, but struggles to stay current with information technology (IT).

IT and knowledge management are not mature disciplines. The services struggle to choose durable standards, processes and systems, and field them across a vast enterprise quickly. Additionally, complex acquisition and configuration processes are incapable of producing interoperable networks on the timescale of IT growth. Though the services and agencies have fielded capable systems in the past, they become legacy if a newer standard is adopted that disenfranchises them. Organizational transformation is required to support flexibility in the Department of Defense.

Sea Power 21 is a comprehensive attempt to address the implications of the IT revolution. The legs of the vision are Sea Basing, Sea Shield and Sea Strike. The enabler is FORCEnet, "the operational construct and architectural framework of naval warfare in the information age that integrates Warriors, sensors, networks, command and control, platforms, and weapons into a networked, distributed combat force that is scalable across all levels of conflict from seabed to space and sea to land."

KEYWORDS: Sea Power 21, FORCEnet, Architecture, Framework, Joint Fires Network, JFN

AN EXPERIMENT IN USING CONTENT PLACED ON THE INTERNET AS A VEHICLE FOR INFLUENCING PUBLIC OPINION

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In this thesis, the potential for using content placed on the Internet as a vehicle for influencing public opinion is explored. An experiment was conducted with 110 subjects to test whether subtle changes in a headline for a news article, without changing the content of the article, can affect a user's perception of the news event reported in the article. These online news articles were assembled from a number of major news organizations. The subjects were divided into three groups, each of which was exposed to a different version of the headline: positively biased, negatively biased, and unchanged from the original headline. Afterwards, the subjects completed a survey to indicate their views on the news events. This data was then analyzed to determine the cause-effect relationship between perception of the news event and the version of the headline. A detectable influence was found when using positively biased headlines to lessen the impact of negatively biased news stories, although the influence was not statistically significant. No evidence regarding the influence of negatively biased headlines on negatively biased news stories was discovered. This research focused on detecting the potential influence of subtle changes and does not address the potential influence of less subtle changes.

KEYWORDS: Persuasion, Internet, Perception Management, Influence

MASTER OF ARTS

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